BOMBARDIER

de Havilland

Material Specification

TITLE:	**HIGH STRENGTH EPOXY ADHESIVE TWO PART**
SPECIFICATION NUMBER:	**DHMS A 6.12**
ISSUE:	**C**
AMENDMENT:	**2**
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Prepared by: Approved by:

SIGNED ORIGINAL ON FILE

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	HIGH STRENGTH EPOXY ADHESIVE TWO PART	

REVISION RECORD

Issue	Page	Description and Reason for Change
A		This is a complete revised issue. Detail changes have not been noted.
A Amd.1	3	Para. 3.2.2 Shear Strength has changed from 2000 psi to 2500 psi.
Amd. 2	2	Storage life has changed from 12 months from DOM to 24 months from date of shipment.
B	2	Para. 1.1, cure time clarified.
	3	Para. 3.2 Cure details changed
		This is a complete revised issue.
C		This is a complete revised issue.
	2	Para. 3.1.1 definition of material properties clarified.
	3	Para. 3.2.3, 3.24 , number of specimens Was: three, Now: five
		Para. 4.1 Clarified test specimen description , added another view for Figure 1 , standardizing with ASTM D1002
	7	Table 1, clarified test requirement for batch acceptance test, three specimens are required.
Amd. 1	QPL	Revised 3M Manufacturer address to reflect actual manufacturing site, not office site.
Amd. 2	2	Para. 2.2 updated ASTM designation
	7,8	Removed Sampling Plan Table 2.
		Para. 8.2 clarify packaging

1 SCOPE

This specification covers the requirements for a flexible, two part, room temperature curing structural adhesive with high shear and peel strength.

1.1 Type

Type 1	Shall cure within 7 days at 24°C (75°F ± 5°F)

2 APPLICABLE DOCUMENTS

The following document shall form part of this specification of the adhesive defined herein. In the event of conflicting requirements between this and the requirement listed below, the requirement of this specification shall govern. Where a specific issue of a document is not stated, the current issue shall be used.

2.1 Military Specifications

MIL-A-82720	Adhesive, Modified-epoxy, Flexible, Two Part

2.2 American Society for Testing and Materials

ASTM D1002	Strength Properties of Adhesive in Shear by Tension Loading
ASTM D1876	Test method for Peel Resistance of Adhesive (T-Peel Test)

2.3 de Havilland Specifications

DHMS A6.03	Modified Epoxy, Moderate Temperature Curing, High Strength, Structural Adhesive System

3 REQUIREMENTS

3.1 Properties of Liquid Phase

3.1.1 Material: The adhesive shall be a thermosetting epoxy type capable of meeting the requirements of this specification.

3.1.2 Components: The adhesive shall be a two-component system consisting of a base component and a catalyst. The components shall be packaged in separate containers. The catalyst shall not be batch oriented to the polymer base component.

3.1.3 Mixing Ratio: The adhesive, when mixed according to the manufacturer's recommended mixing ratio, shall conform to the requirements of this specification.

3.1.4 Storage Life: The storage life of the base component and the catalyst shall be 24 months from the date of shipment, when stored in separate, tightly closed containers at temperature of 16° to 26° C.

3.1.5 Pot Life: The adhesive when mixed, shall be useable for up to 90 minutes at a temperature of 24°C (75°F ± 5°F) and relative humidity not greater than 60%

3.1.6 Working Characteristics: The adhesive components, at any production volume shall be capable of being hand mixed to

a smooth, homogeneous, lump free consistency suitable for hand application by brush. The components shall not separate in any way within the specified pot life.

3.2 Properties of Solid Phase

3.2.1 Curing Time: The mixed adhesive in a sandwich assembly shall cure to handle consistency within 72 hours at 75°F ± 5°F (24°C) or 2 hours at 140°F± 5°F (60°C).

3.2.2 Full cure can be achieved after 7 days at 75°F ± 5°F (24°C) or 4 hours at 140°F± 5°F (60°C).

3.2.3 Shear Strength: The average shear strength of five specimens, prepared and tested per **Para.4.1** shall be a minimum of 2500 psi when tested at 75°F ± 5°F (24°C).

3.2.4 Peel Strength: The average peel strength of five specimens, prepared and tested per **Para.4.2** shall be 25 lb/inch minimum when tested at 75°F ± 5°F (24°C).

Reporting: Record materials batch/lot number, class and type of adhesive, testing conditions, type of failure (cohesive, adhesive) and the tensile shear or peel strength of each sample.

4 TEST METHOD

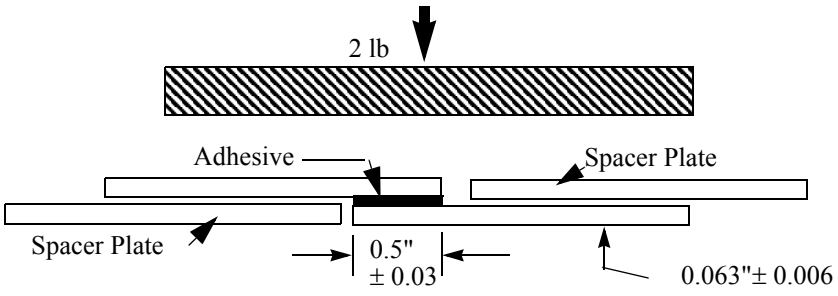
4.1 Shear Strength

The test specimen shall consist of two pieces of 7" x 4" , 0.063" thick 2024 T3 aluminum alloy. The aluminum shall be phosphoric acid anodized and primed with DHMS A6.03-1 adhesive primer. Specimen shall be prepared and tested as follows:

1. Apply a light coat of adhesive to both bonding surfaces , position both bond surfaces to produce a 0.5" overlap and place 0.060" spacer plates over and under the test panel as shown in **Figure 1**.

2. Allow to cure under a 2 lb weight.

3. After curing, cut the test panels into one inch wide specimens and test per ASTM D1002.



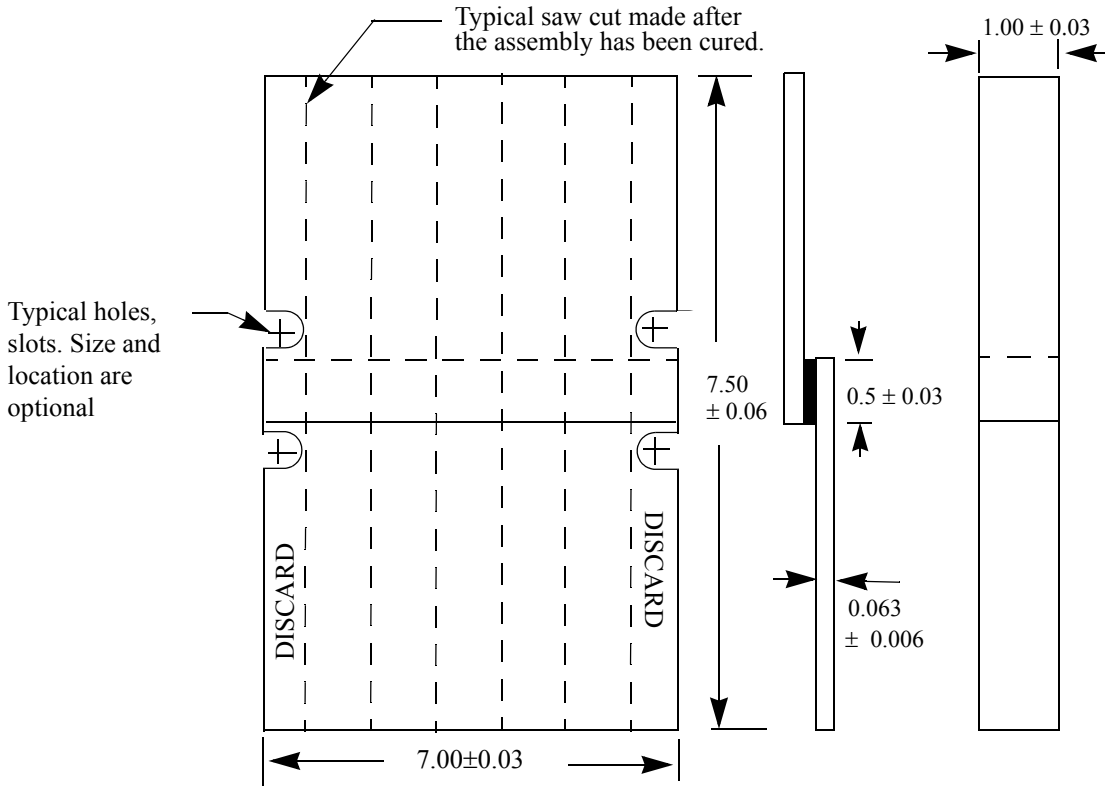


FIGURE 1. Lap Shear Test Panel

4.2 Peel Strength

The test specimen shall consist of two pieces of 12" x 6" x 0.020" 2024 T3 aluminum alloy. The aluminum shall be phosphoric acid anodized and primed with DHMS A6.03-1 adhesive primer. The test specimen shall be prepared and tested as follows:

1. Apply a uniform coat of adhesive to both surfaces of the test panel as outlined in **Figure 2**.
2. Assemble the panels together and allow the adhesive to cure as per **Para.3.2.1**.
3. After curing, cut the test panel into one inch specimens and test per ASTM D1876.

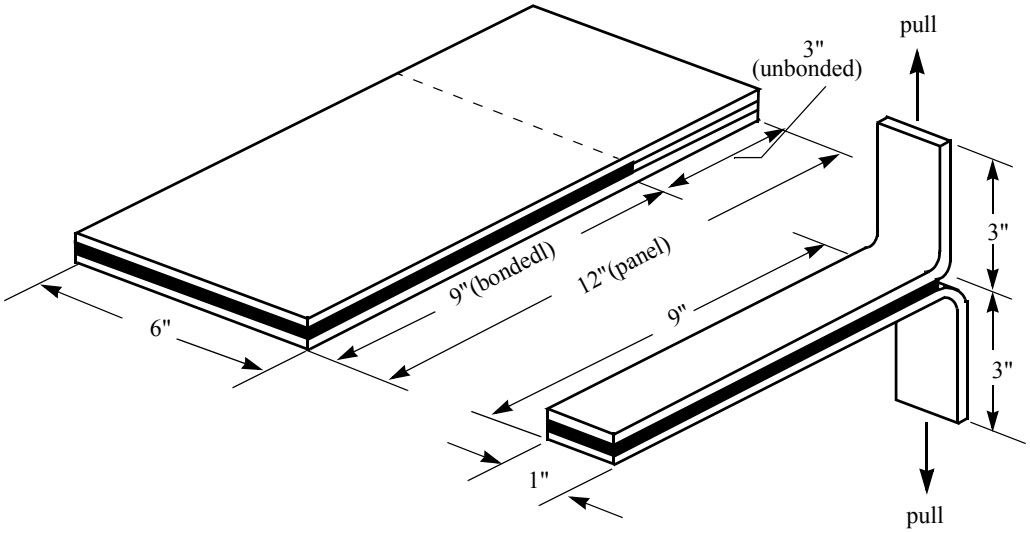


FIGURE 2. T- Peel Test Panel

5 MATERIAL QUALIFICATION REQUIREMENTS

5.1 Request For Qualification

All requests for qualification to this specification shall be addressed to Bombardier Aerospace Materials Technology Engineering department for approval.

All material qualification shall be site specific.

An audit of the manufacturers and/or test facilities by Materials Technology Engineering may be necessary prior to approval.

5.2 Qualification testing

Potential suppliers shall submit a written qualification test report based on 3 batches/lots of materials showing compliance with the requirements contained in section 3. The test report shall contain actual numerical test values, average test results as well as failure modes where applicable.

5.2.1 A sample shall be submitted for testing at the discretion of Bombardier Aerospace Materials Technology for evaluation.

5.3 Qualification by Similarity

Where a product has been qualified to another similar specification, the supplier may submit the qualification data applicable to this specification for consideration. The similar specification may be a government, company, or other specification where the requirements are similar to this specification.

5.4 Process Control Document

5.4.1 The manufacturer shall develop and maintain a Process Control Document (PCD). The PCD shall define the manufacturing and quality control requirements and procedures for assuring consistent, uniform and compliant products. The PCD shall identify baseline chemical constituents, in-process test procedures and requirements, and manufacturing procedures. All specifications and test procedures employed during the process shall also be listed and issue/date controlled.

5.4.2 When qualification has been granted, the PCD shall be signed by the supplier and Bombardier Aerospace Materials Technology Engineering and shall not be changed without prior written approval.

5.4.3 The PCD and all production data shall be available to any Bombardier Aerospace auditors when requested.

5.5 Qualification Approval

5.5.1 Upon review of supplier's data, PCD and de Havilland tests, the supplier will be advised either of product qualification or reasons for disqualification.Products that are qualified will be listed in the Qualified Products List of this specification.

5.5.2 No changes in the method of manufacture and/or formulation shall be made without notification and prior written approval of Materials Technology Department.

5.5.3 Re-qualification of the product may be requested by the Bombardier Materials Technology if there are any changes in the method of manufacture and/or formulation.

6 QUALITY ASSURANCE REQUIREMENTS

6.1 Manufacturer Batch/Lot Acceptance Tests

6.1.1 The manufacturer/supplier is responsible for the performance of all sampling, inspection and testing of each batch/lot as specified in **Table 1.**

6.1.2 The manufacturer/supplier shall issue with each batch of product one copy of an Acceptance Test Report showing actual test data conformance to the acceptance tests specified in **Table 1**. The report shall include the supplier's batch identification, materials specification and date of testing.

6.1.3 Bombardier Aerospace Materials Technology Engineering reserves the right to perform any or all of the tests set forth in this specification to ensure that the product continues to meet specification requirements. Any product not meeting the requirements of this specification will be returned to the supplier at the supplier's expense.

6.1.4 The manufacturer/supplier shall certify with a Certificate Conformance that each batch of each shipment meets the requirements of this specification.

6.2 Purchaser Batch/Lot acceptance tests

The purchaser is required to perform of all sampling, inspection and testing of each batch/lot as specified in **Table 1.**

Table 1: Qualification and Batch Acceptance Tests

Properties	Paragraph	Qualification (Manufacturer/ Supplier)	Acceptance (Manufacturer/supplier purchaser/user)
Storage Life	**Para.3.1.4**	x	
Pot Life	**Para.3.1.5**	x	
Curing Time	**Para.3.2.1**	x	
Shear Strength	**Para.3.2.3**	x	x[1]
Peel Strength	**Para.3.2.4**	x	

1. For receipt testing, minimum of three specimens are required.

6.2.1 Batch is defined as the end product of all the raw materials mixed and/or manufactured at the same time and place. The weight or volume may vary, depending upon the capacity of the manufacturer's facilities.

6.2.2 Lot is defined as the total quantity of product in a shipment taken from the same batch.

7 ORDERING DATA

7.1 Prerequisite

Material furnished under this specification for production use shall be qualified and tested on the Qualified Products List prior to issuing a Purchase Order.

7.2 Procurement Documents

Procurement documents should specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Type and Size of Container (Imperial or U.S. measure)
- Total Quantity (Imperial or U.S. measure)
- Acceptance Test Report.

8 PREPARATION FOR DELIVERY

8.1 Preservation and Packing

The adhesive shall be packed in such a manner as to assure that, during shipment and storage, the product will be protected against damage from exposure to hazards which would affect adversely the property conformance to Section 3 of this specification.

8.2 Packaging

The adhesive base and catalyst shall be packed in separate containers as specified as per purchase order.

8.3 Marking

Each container shall be legibly marked with the follow information:

- Adhesive, Epoxy (conforms to DHMS A6.12, Type 1)
- Component 1 (base)
- Component 2 (catalyst)
- Applicable Mixing Ratio
- Manufacturer’s Name and Product Identification
- Date of Manufacture
- Batch Number

- Net Quantity (Imperial or U.S. measure)

8.4 Shipping Documentation

The shipping document shall show:

- de Havilland Purchase Order No.
- Specification Number
- Number of Containers
- Batch Number
- Total Quantity (Imperial or U.S. measure)
- Acceptance Test Reports

Each shipment shall contain a copy of the Material Safety Data Sheet.

9 HEALTH AND SAFETY DATA

When supplying samples for qualification per **Para.5.1**, the supplier shall submit a Material Safety Data Sheet as per the Ontario Occupational Health and Safety Act, Workplace Hazardous Materials Information System (WHMIS) Relations, which complies with the Canada Hazardous Products Act, Controlled Products Regulations

Materials Technology, de Havilland Inc. must ensure that copies are provided to, and approved by, the Materials Safety Committee, Industrial Hygiene and Safety, de Havilland Inc.

These requirements are prerequisites to inclusion of any product on the Qualified Products List.

Any changes in the formulation of the material requires resubmission of the Material Safety Data Sheet.

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	MATERIAL SAFETY DATA SHEET NO.	DE HAVILLAND QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
3M Company. 3211 Chestnut Expressway E. Springfield, MO 65802 USA	EC 2216 B/A Gray Part A Part B	 2013 2014	PQS #1	June l5,1994